

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re New DIVISIONAL Patent Application of:)
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Shigeru SAKUMA et al.)
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Application No.: Not yet Assigned)
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Filed: October 22, 2001)
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Prior Application No.: 09/257,296)
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Prior Application Filed: February 25, 1999)
)
For: MANUFACTURING METHOD FOR)
CALCIUM FLUORIDE AND CALCIUM)
FLOURIDE FOR PHOTOLITHOGRAPHY)

Group Art Unit: 1765

Examiner: B. Tran

Commissioner for Patents
Washington D.C. 20231

PRELIMINARY AMENDMENT

Sir:

Prior to examination of the above-identified application on the merits, please amend the application as follows:

Please cancel claims 17-19 and 40-42.

Please amend claims 1, 9, 20, 21, 22, 26, and 33, to read as follows:

(Amended) A manufacturing method for a single crystal of calcium fluoride, having its optical properties improved through an annealing process comprising the steps of:

providing a single crystal of calcium fluoride in a sealable container, sealing said container, then

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heating said container with a heater arranged external to said container such that a temperature inside said container is raised to a first temperature, which is lower than a melting point of said single crystal of calcium fluoride,

maintaining the temperature inside said container at said first temperature for a designated period of time,

lowering the temperature inside said container to room temperature,

wherein,

the first temperature is between 1020 °C to 1150 °C.

9. (Amended) A manufacturing method for a single crystal of calcium fluoride having its optical properties improved comprising the steps of:

providing a single crystal of calcium fluoride and a fluorination agent in a second container arranged in a sealable first container, sealing said first container, then

heating said first container with a heater arranged external to said first container such that a temperature inside said second container is raised to a first temperature, which is lower than a melting point of said single crystal of calcium fluoride, while said second container is filled with a fluorine gas atmosphere,

maintaining the temperature inside said second container at the first temperature for a designated period of time,

lowering the temperature inside said first container and the temperature inside said second container to room temperature,

opening the inside of said first container to a normal atmosphere,

wherein,

the first temperature is between 1020 °C and 1150 °C.

20. (Amended) A manufacturing method for a single crystal of calcium fluoride, having its optical properties improved comprising the steps of:

providing a single crystal of calcium fluoride in a sealable container, sealing said container, then

heating said container with a heater arranged external to said container such that a temperature inside said container is raised to a first temperature, which is lower than a melting point of said single crystal of calcium fluoride,

maintaining the temperature inside said container at said first temperature for a designated period of time,

lowering the temperature inside said container to room temperature,

wherein,

a balance between an effect of improving the optical properties of said single crystal of calcium fluoride and the productivity, including delivery time and cost, is achieved, such that, during a high temperature range, the temperature is lowered at a slow rate, and during a low temperature range that is lower than the high temperature range, the temperature is lowered faster as the temperature becomes lower.

21. (Amended) A manufacturing method for a single crystal of calcium fluoride, having its optical properties improved comprising the steps of:

providing a single crystal of calcium fluoride in a sealable container, sealing said container, then

heating said container with a heater arranged external to said container such that a temperature inside said container is raised to a first temperature, which is lower than a melting point of said single crystal of calcium fluoride,

maintaining the temperature inside said container at said first temperature for a designated period of time,

lowering the temperature inside said container to room temperature,

wherein,

said container is filled with an inert gas, and the inside of said container is maintained at an atmosphere of approximately 1 atm such that said single crystal of calcium fluoride is not oxidized.

22. (Amended) A manufacturing method for a single crystal of calcium fluoride having its optical properties improved comprising the steps of:

providing a single crystal of calcium fluoride and a fluorination agent in a second container arranged in a sealable first container, sealing said first container, then

heating said first container with a heater arranged external to said first container such that the temperature inside said second container is raised to a first temperature, which is lower than a

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melting point of said single crystal of calcium fluoride, while said second container is filled with a fluorine gas atmosphere,

A³ maintaining the temperature inside said second container at the first temperature for a designated period of time,

lowering the temperature inside said second container to room temperature, and

opening the inside of said first container to a normal atmosphere,

wherein,

at a minimum, in order to prevent oxidation of said single crystal of calcium fluoride during the process, the process is carried out such that said fluorination agent is vaporized and becomes a fluorine gas atmosphere inside of said second container, while a pressure inside said first container is maintained at approximately 1 atm.

26. (Amended) A manufacturing method for a single crystal of calcium fluoride, having its optical properties improved comprising the steps of:

A⁴ providing a single crystal of calcium fluoride in a sealable container, sealing said container, then

heating said container with a heater arranged external to said container such that a temperature inside said container is raised to a first temperature, which is lower than a melting point of said single crystal of calcium fluoride,

maintaining the temperature inside said container at the first temperature for a designated period of time,

lowering the temperature inside said container to room temperature,

wherein,

the first temperature, which is between 1020 °C and 1150 °C, is lowered to a second temperature, which is in the range of around 600 °C to 900 °C, at a rate of 1.2 °C/hour or less.

33. (Amended) A manufacturing method for a single crystal of calcium fluoride having its optical properties improved comprising the steps of:

providing a single crystal of calcium fluoride and a fluorination agent in a second container arranged in a sealable first container, sealing said first container, then

heating said first container with a heater arranged external to said first container such that a temperature inside said second container is raised to a first temperature, which is lower than a melting point of said single crystal of calcium fluoride, while said second container is filled with a fluorine gas atmosphere,

maintaining the temperature inside said second container at said first temperature for a designated period of time,

lowering the temperature inside second container to room temperature,

opening the inside of said first container to a normal atmosphere,

wherein,

the first temperature is between 1020 °C and 1150 °C, and

the temperature is decreased from said first temperature to a second temperature, which is in the range of around 600 to 900 °C, at a rate of 1.2 °C/hour or less.